2. If monitoring is conducted annually, or less frequently, the system is out of compliance if the level of a contaminant at any sampling point is greater than the MCL. If a confirmation sample is required by the department, the determination of compliance will be based on the average of two samples.

3. If a public water system has a distribution system separable from other parts of the distribution system with no interconnections, the department may allow the system to give public notice to only that portion of the system which is out of compliance.

(3) Treatment techniques for acrylamide and epichlorohydrin. Each public water supply system must certify annually in writing to the department (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified as follows:

Acrylamide = 0.05% dosed at 1 ppm (or equivalent)

Epichlorohydrin = 0.01% dosed at 20 ppm (or equivalent)

Certifications can rely on information provided by manufacturers or third parties, as approved by the department.

c. Organic chemical monitoring requirements. Each public water system shall monitor at the time designated within each compliance period.

(1) Routine volatile organic chemical (VOC) monitoring requirements. Beginning on January 1, 1993, community water supplies and NTNC water supplies shall conduct monitoring of the contaminants listed in 41.5(1)*"b"*(1) for the purpose of determining compliance with the maximum contaminant level.

(2) VOC monitoring protocol.

1. VOC groundwater monitoring protocol. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment (hereafter called a source/entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

2. VOC surface water monitoring protocol. Surface water systems (and combined surface/groundwater systems) shall take a minimum of one sample at each entry point to the distribution system after treatment (hereafter called a source/entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

3. Multiple sources. If the system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water representative of all sources is being used). If a representative sample of all water sources cannot be obtained, as determined by the department, separate source/entry points with the appropriate monitoring requirements will be assigned by the department.

4. Initial VOCs monitoring frequency. Each community and nontransient noncommunity water system shall take four consecutive quarterly samples for each contaminant listed in 41.5(1)*"b"*(1) during each compliance period, beginning in the initial compliance period. If the initial monitoring for contaminants listed in 41.5(1)*"b"*(1) has been completed by December 31, 1992, and the system did not detect any contaminant listed in 41.5(1)*"b"*(1), then each groundwater and surface water system shall take one sample annually beginning with the initial compliance period.

5. Reduced VOC monitoring for groundwater systems. After a minimum of three years of annual sampling, the department may allow groundwater systems with no previous detection of any contaminant listed in 41.5(1)*"b"*(1) to take one sample during each compliance period.

6. VOC monitoring waivers. Each community and nontransient noncommunity groundwater system which does not detect a contaminant listed in 41.5(1)*"b"*(1) may apply to the department for a waiver from the requirements of 41.5(1)*"c"*(2)"4" and "5" after completing the initial monitoring. A waiver shall be effective for no more than six years (two compliance periods). The department may also issue waivers to small systems for the initial round of monitoring for 1,2,4-trichlorobenzene. Detection is defined as greater than or equal to 0.0005 mg/L.

7. Bases of a VOC monitoring waiver. The department may grant a waiver if the department finds that there has not been any knowledge of previous use (including transport, storage, or disposal) of the contaminant within the watershed or zone of influence of the system. If previous use of the contaminant is unknown or it has been used previously, then the following factors shall be used to determine whether a waiver is granted.

- Previous analytical results.
- The proximity of the system to a potential point or nonpoint source of contamination. Point sources include spills and leaks of chemicals at or near a water treatment facility or at manufacturing, distribution, or storage facilities, or from hazardous and municipal waste landfills and other waste handling or treatment facilities.
- The environmental persistence and transport of the contaminants.
- The number of persons served by the public water system and the proximity of a smaller system to a larger system, and
- How well the water source is protected against contamination, such as whether it is a surface or groundwater system. Groundwater systems must consider factors such as depth of the well, the type of soil, and wellhead protection. Surface water systems must consider watershed protection.

8. VOC monitoring waiver requirements for groundwater systems. As a condition of the waiver, a groundwater system must take one sample at each sampling point during the time the waiver is effective (i.e., one sample during two compliance periods or six years) and update its vulnerability assessment considering the factors listed in 41.5(1)*"c"*(2)"7." Based on this vulnerability assessment the department must reconfirm that the system is nonvulnerable. If the department does not reconfirm within three years of the initial vulnerability determination, then the waiver is invalidated and the system is required to sample annually as specified in 41.5(1)*"c"*(2)"4."

9. VOC monitoring waiver requirements for surface water systems. Each community and nontransient noncommunity surface water system which does not detect a contaminant listed in 41.5(1)*"b"*(1) may apply to the department for a waiver from the requirements of 41.5(1)*"c"*(2)"4" after completing the initial monitoring. Composite samples from a maximum of five sampling points are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Systems meeting this criterion must be determined by the department to be nonvulnerable based on a vulnerability assessment during each compliance period. Each system receiving a waiver shall sample at the frequency specified by the department (if any).

10. Increased VOC monitoring. If a contaminant listed in 41.5(1)*"b"*(1) is detected at a level exceeding 0.0005 mg/L in any sample, then:

The system must monitor quarterly at each sampling point which resulted in a detection.

The department may decrease the quarterly monitoring requirement specified in 41.5(1)*"c"*(2)"4" provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case shall the department make this determination unless a groundwater system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.

If the department determines that the system is reliably and consistently below the MCL, the department may allow the system to monitor annually. Systems which monitor annually must monitor during the quarter(s) which previously yielded the highest analytical result.

Systems which have three consecutive annual samples with no detection of a contaminant may apply to the department for a waiver as specified in 41.5(1)*"c"*(2)"6."

Groundwater systems which have detected one or more of the following two-carbon organic compounds: trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, or 1,1-dichloroethylene shall monitor quarterly for vinyl chloride. A vinyl chloride sample shall be taken at each sampling point at which one or more of the two-carbon organic compounds was detected. If the results of the first analysis do not detect vinyl chloride, the department may reduce the quarterly monitoring frequency of vinyl chloride monitoring to one sample during each compliance period. Surface water systems are required to monitor for vinyl chloride as specified by the department.

11. VOCs reliably and consistently below the MCL. Systems which violate the MCL requirements of 41.5(1)*"b"*(1) must monitor quarterly. After a minimum of four consecutive quarterly samples which show the system is in compliance and the department determines that the system is reliably and consistently below the maximum contaminant level, the system may monitor at the frequency and times specified in 41.5(1)*"c"*(2)"10," third unnumbered paragraph (following approval by the department).

(3) Routine and repeat synthetic organic chemical (SOC) monitoring requirements. Analysis of the synthetic organic contaminants listed in 41.5(1)*"b"*(1) for the purposes of determining compliance with the maximum contaminant level shall be conducted as follows:

1. SOC groundwater monitoring protocols. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment (hereafter called a source/entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

2. SOC surface water monitoring protocols. Surface water systems shall take a minimum of one sample at each entry point to the distribution system after treatment (hereafter called a source/entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant. For purposes of this paragraph, surface water systems include systems with a combination of surface and ground sources.

3. Multiple sources. If the system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water representative of all sources is being used). If a representative sample of all water sources cannot be obtained, as determined by the department, separate source/entry points with the appropriate monitoring requirements will be assigned by the department.

4. SOC monitoring frequency. Community and nontransient noncommunity water systems shall take four consecutive quarterly samples for each contaminant listed in 41.5(1)*"b"*(1) during each compliance period beginning with the compliance period starting January 1, 1993. Systems serving more than 3,300 persons which do not detect a contaminant in the initial compliance period may reduce the sampling frequency to a minimum of two quarterly samples in one year during each repeat compliance period. Systems serving less than or equal to 3,300 persons which do not detect a contaminant in the initial compliance period may reduce the sampling frequency to a minimum of one sample during each repeat compliance period.

5. SOC monitoring waivers. Each community and nontransient water system may apply to the department for a waiver from the requirements of 41.5(1)*"c"*(3)"4." A system must reapply for a waiver for each compliance period.

6. Bases of an SOC monitoring waiver. The department may grant a waiver if the department finds that there has been no knowledge of previous use (including transport, storage, or disposal) of the contaminant within the watershed or zone of influence of the system. If previous use of the contaminant is unknown or it has been used previously, then the department shall determine whether a waiver may be granted by considering:

- Previous analytical results.
- The proximity of the system to a potential point or nonpoint source of contamination. Point sources include spills and leaks of chemicals at or near a water treatment facility or at manufacturing, distribution, or storage facilities, or from hazardous and municipal waste landfills and other waste handling or treatment facilities. Nonpoint sources include the use of pesticides to control insect and weed pests on agricultural areas, forest lands, home and gardens, and other land application uses.
- The environmental persistence and transport of the pesticide or PCBs.
- How well the water source is protected against contamination due to such factors as depth of the well and the type of soil and the integrity of the well casing.
- Elevated nitrate levels at the water supply source, and
- Use of PCBs in equipment used in the production, storage, or distribution of water (i.e., PCBs used in pumps and transformers).

7. Increased SOC monitoring. If a synthetic organic contaminant listed in 41.5(1)*"b"*(1) is detected in any sample, then:

- Each system must monitor quarterly at each sampling point which resulted in a detection.
- The department may decrease the quarterly SOC monitoring requirement if the system is reliably and consistently below the maximum contaminant level. In no case shall the department make this determination unless a groundwater system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.
- After the department determines the system is reliably and consistently below the maximum contaminant level, the system may monitor annually. Systems which monitor annually must monitor during the quarter that previously yielded the highest analytical result.
- Systems which have three consecutive annual samples with no detection of a contaminant may apply to the department for a waiver as specified in 41.5(1)*"c"*(3)"6."
- If monitoring results in detection of one or more of certain related contaminants (aldicarb, aldicarb sulfone, aldicarb sulfoxide, heptachlor, and heptachlor epoxide), then subsequent monitoring shall analyze for all related contaminants.

8. MCL violation and reliably/consistently below the MCL. Systems which violate the requirements of 41.5(1)*"b"* must monitor quarterly. After a minimum of four quarterly samples show the system is in compliance and the department determines the system is reliably and consistently below the MCL, the system shall monitor at the frequency specified in 41.5(1)*"c"*(3)"7."

(4) Organic chemical (SOC and VOC) confirmation samples. The department may require a confirmation sample for positive or negative results. If a confirmation sample is required by the department, the result must be averaged with the first sampling result and the average is used for the compliance determination as specified by 41.5(1)*"b"*(2). The department has discretion to disregard results of obvious sampling errors from this calculation.

(5) Organic chemical (SOC and VOC) composite samples. The department may reduce the total number of samples a system must analyze by allowing the use of compositing. Composite samples from a maximum of five sampling points are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Compositing of samples must be done in the laboratory and analyzed within 14 days of sample collection.

1. If the concentration in the SOC or VOC composite sample is greater than or equal to 0.0005 mg/L for any contaminant listed in 41.5 (1)*"b"*(1), then a follow-up sample must be taken and analyzed within 14 days from each sampling point included in the composite.

2. If duplicates of the original sample taken from each sampling point used in the composite are available, the system may use these instead of resampling, provided the holding time of the samples is not exceeded. The duplicates must be analyzed and the results reported to the department within 14 days after completing analysis of the composite sample.

3. Compositing may only be permitted by the department at sampling points within a single system, unless the population served by the system is less than 3,300 persons. In systems serving less than or equal to 3,300 persons, the department may permit compositing among different systems provided the five-sample limit is maintained.

4. Compositing samples prior to gas chromatographic analysis.

- Add 5 mL or equal larger amounts of each sample (up to five samples are allowed) to a 25-mL glass syringe. Special precautions must be made to maintain zero headspace in the syringe.
- The samples must be cooled at 4 degrees Celsius during this step to minimize volatilization losses.
- Mix well and draw out a 5-mL aliquot for analysis.
- Follow sample introduction, purging, and desorption steps described in the method.
- If less than five samples are used for compositing, a proportionately small syringe may be used.

5. Compositing samples prior to gas chromotographic/mass spectrometric analysis.

- Inject 5 mL or equal larger amounts of each aqueous sample (up to five samples are allowed) into a 25-mL purging device using the sample introduction technique described in the method.
- The total volume of the sample in the purging device must be 25 mL.
- Purge and desorb as described in the method.

6. Grandfathered organic chemical (SOC and VOC) data. The department may allow the use of monitoring data collected after January 1, 1988, for VOCs and January 1, 1990, for SOCs required under Section 1445 of the Safe Drinking Water Act for purposes of initial monitoring compliance. If the data are generally consistent with the other requirements in this subparagraph, the department may use such data (i.e., a single sample rather than four quarterly samples) to satisfy the initial monitoring requirement for the initial compliance period beginning January 1, 1993. Systems which use grandfathered samples for VOCs and did not detect any contaminants listed in 41.5(1)*"b"*(1) shall begin monitoring annually in accordance with 41.5(1)*"c"*(2) beginning January 1, 1993.

7. Increased organic chemical (SOC and VOC) monitoring. The department may increase the required monitoring frequency, where necessary, to detect variations within the system (e.g., fluctuations in concentration due to seasonal use, changes in water source, changes to treatment facilities or normal operation thereof).

8. Organic chemical (SOC and VOC) vulnerability assessment criteria. Vulnerability of each public water system shall be determined by the department based upon an assessment of the following factors.

- VOC vulnerability assessment criteria—previous monitoring results. A system will be classified vulnerable if any sample was analyzed to contain one or more contaminants listed in 41.5(1)*"b"*(1)-(VOCs) or 41.5(1)*"b"*(3) except for trihalomethanes or other demonstrated disinfection by-products.
- SOC vulnerability assessment criteria—previous monitoring results. A system will be classified vulnerable if any sample was analyzed to contain one or more contaminants listed in 41.5(1)*"b"*(2)-(SOCs) or 41.5(1)*"b"*(3) except for trihalomethanes or other demonstrated disinfection by-products.
- Proximity of surface water supplies to commercial or industrial use, disposal or storage of volatile synthetic organic chemicals. Surface waters which withdraw water directly from reservoirs are considered vulnerable if the drainage basin upgradient and within two miles of the shoreline at the maximum water level contains major transportation facilities such as primary highways or railroads or any of the contaminant sources listed in this subparagraph. Surface water supplies which withdraw water directly from flowing water courses are considered vulnerable if the drainage basin upgradient and within two miles of the water intake structure contains major transportation facilities such as primary highways or railroads or any of the contaminant sources listed in this subparagraph.

• Proximity of supplies to commercial or industrial use, disposal or storage of volatile synthetic organic chemicals. Wells that are not separated from sources of contamination by at least the following distances will be considered vulnerable.

Sources of Contamination	Shallow Wells as defined in 567—40.2(455B)	Deep Wells as defined in 567—40.2(455B)
Sanitary and industrial point discharges	400 ft	400 ft
Mechanical waste treatment plants	400 ft	200 ft
Lagoons	1,000 ft	400 ft
Chemical and storage (aboveground)	200 ft	l00 ft
Chemical and mineral storage including underground storage tanks on or below ground	400 ft	200 ft
Solid waste disposal site	1,000 ft	1,000 ft

• A system is deemed to be vulnerable for a period of three years after any positive measurement of one or more contaminants listed in 41.5(1)*"b"*(3) except for trihalomethanes or other demonstrated disinfection by-products.

d. Best available technology(ies) (BATs). Rescinded IAB 8/11/99, effective 9/15/99.

e. Total trihalomethanes sampling, analytical and other requirements. The maximum contaminant level for total trihalomethanes applies to community water systems which serve a population of 10,000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the treatment process. Compliance with the maximum contaminant level is calculated pursuant to 41.5(1)*"b"*(1). Total trihalomethanes is the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform) and trichloromethane (chloroform).

(1) Applicability. Community water systems which use a groundwater source, serve a population of 10,000 or more individuals, and which add disinfectant (oxidant) to the water in any part of the drinking water treatment process shall analyze for total trihalomethanes in accordance with this subrule, until December 31, 2003, after which time the systems must comply with 41.6(455B). The requirements of this subrule also apply to community water systems which use surface water or IGW in whole or in part and serve 10,000 or more persons, until December 31, 2001, after which time the systems must comply with 41.6(455B). After December 31, 2003, paragraph 41.5(1)*"e"* is no longer applicable to any Iowa public water supply.

1. For the purpose of this subrule, samples to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing water from a single aquifer may, with approval of the department, be considered as one treatment plant for determining the minimum number of samples.

2. All samples required within a calendar quarter shall be collected within a 24-hour period.

(2) General sampling requirements.

1. For all community water systems utilizing surface water sources in whole or in part, and for all community water systems utilizing only groundwater sources that have not been determined by the department to qualify for the monitoring requirements of 41.5(1)*"e"*(3), analyses for total trihalomethanes shall be performed at quarterly intervals on at least four water samples for each treatment plant used by the system. At least 25 percent of the samples shall be taken at locations within the distribution system reflecting the maximum residence time of the water in the system. The remaining 75 percent shall be taken at representative locations in the distribution system, taking into account number of persons served, different sources of water and different treatment methods employed. The results of all analyses per quarter shall be arithmetically averaged. All samples collected shall be used in the computation of the average, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in 41.5(1)*"e"*(5).

2. The department may allow a community water system to reduce the monitoring frequency required by 41.5(1)*"e"*(2)"1" to a minimum of one sample analyzed for TTHMs per quarter taken at a point in the distribution system reflecting the maximum residence time of the water in the system, upon a determination by the department that the data from at least one year of monitoring in accordance with 41.5(1)*"e"*(2)"1" and local conditions demonstrate that total trihalomethane concentrations will be consistently below the maximum contaminant level.

3. If at any time during which the reduced monitoring frequency prescribed under 41.5(1)*"e"*(2)"2" applies, the results from any analysis exceed 0.10 mg/L of TTHMs and such results are confirmed by at least one check sample taken promptly after such results are received, or if the system makes any significant change to its source of water or treatment program, the system shall immediately begin monitoring in accordance with the requirements of 41.5(1)*"e"*(2)"1" which monitoring shall continue for at least one year before the frequency may be reduced again. The department may increase a system's monitoring frequency above the minimum in those cases where the department determines it is necessary to detect variations of TTHM levels within the distribution system.

(3) Groundwater sampling requirements.

1. The department may allow a community water system utilizing only groundwater sources to reduce the monitoring frequency required by 41.5(1)*"e"*(2)"1" to a minimum of one sample for maximum TTHM potential per year for each treatment plant used by the system taken at a point in the distribution system reflecting maximum residence time of the water in the system. The system's monitoring frequency may only be reduced upon a determination by the department that, based upon the data submitted by the system, the system has a maximum TTHM potential of less than 0.10 mg/L and that, based upon an assessment of the local conditions of the system, the system is not likely to approach or exceed the maximum contaminant level for TTHMs. All samples collected shall be used for determining whether the system must comply with the monitoring requirements of 41.5(1)*"e"*(2), unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in 41.5(1)*"e"*(5).

2. If at any time during which the reduced monitoring frequency prescribed under 41.5(1)*"e"*(3)"1" applies, the results from any analysis taken by the system for the maximum TTHM potential are equal to or greater than 0.10 mg/L, and such results are confirmed by at least one check sample taken promptly after such results are received, the system shall immediately begin monitoring in accordance with the requirements of 41.5(1)*"e"*(2) and such monitoring shall continue for at least one year before the frequency may be reduced again. In the event of any significant change to the system's raw water or treatment program, the system shall immediately analyze an additional sample for maximum TTHM potential taken at a point in the distribution system reflecting maximum residence time of the water in the system for the purpose of determining whether the system must comply with the monitoring requirements of 41.5(1)*"e"*(2). The department may increase monitoring frequencies above the minimum in those cases where the department determines it is necessary to detect variation of TTHM levels within the distribution system.

(4) Compliance calculation. Compliance with 41.5(1)*"b"*(3) shall be determined based on a running annual average of quarterly samples collected by the system as prescribed in 41.5(1)*"e"*(2)"1" or 41.5(1)*"e"*(2)"2." If the average of samples covering any 12-month period exceeds the maximum contaminant level, the supplier of water shall notify the public pursuant to 567—42.1(455B). Monitoring after public notification shall be at a frequency designated by the department and shall continue until a monitoring schedule as a condition to an operation permit or enforcement action shall become effective.

(5) Sampling and analytical methodology. Sampling and analyses made pursuant to this subrule shall be conducted by one of the approved total trihalomethane methods listed in 41.5(1)*"b."*

Samples for TTHM shall be dechlorinated upon collection to prevent further production of trihalomethanes, according to the procedures described in the above-referenced methods, except acidification is not required if only THMs or TTHMs are to be determined. Samples for maximum TTHM potential should not be dechlorinated or acidified, and should be held for seven days at 25 degrees Celsius (or above) prior to analysis.

(6) System modificiation. Before a community water system makes any modifications to its existing treatment process for the purposes of achieving compliance with the TTHM MCL, such system must submit and obtain department approval of a plan setting forth its proposed modification and any safeguards that it will implement to ensure that the bacteriological quality of the drinking water served by such system will not be adversely affected by such modification.

Each system shall comply with the provisions set forth in the department-approved plan. At a minimum, a department-approved plan shall require any system modifying its disinfection practice to:

1. Evaluate the water system for sanitary defects and evaluate the source for biological quality;
2. Evaluate its existing treatment practices and consider improvements that will minimize disinfectant demand and optimize finished water quality throughout the distribution system;
3. Provide baseline water quality survey data of the distribution system required by the department;
4. Conduct any additional monitoring determined by the department to be necessary to ensure continued maintenance of optimal biological quality in the finished water; and
5. Demonstrate an active disinfectant residual throughout the distribution system at all times during and after the modification.

Before a community water system makes any modifications to its existing physical treatment plant for the purpose of achieving compliance with 41.5(1)*"b"*(3), such system must obtain department approval in accordance with 567—43.3(455B).

(7) Maximum total trihalomethane potential methodology. The water sample for determination of maximum total trihalomethane potential is taken from a point in the distribution system that reflects maximum residence time. Procedures for sample collection and handling are given in the methods. No reducing agent is added to "quench" the chemical reaction producing THMs at the time of sample collection. The intent is to permit the level of THM precursors to be depleted and the concentration of THMs to be maximized for the supply being tested. Four experimental parameters affecting maximum THM production are pH, temperature, reaction time, and the presence of a disinfectant residual. These parameters are dealt with as follows:

1. Measure the disinfectant residual at the selected sampling point. Proceed only if a measurable residual is present.
2. Collect triplicate 40 mL water samples at the pH prevailing at the time of sampling and prepare a method blank according to the methods.
3. Seal and store these samples together for seven days at 25 degrees Celsius or above.
4. After this time period, open one of the sample containers and check for disinfectant residual. Absence of a disinfectant residual invalidates the sample for further analysis.
5. Once a disinfectant residual has been demonstrated, open another of the sealed samples and determine THM concentration using an approved analytical method.

f. Analytical procedures—organics.

(1) Volatile organic chemical (VOC) and synthetic organic chemical (SOC) analytical methods. Analysis for the VOC and SOC contaminants listed in 41.5(1)*"b"*(1) must be conducted using the specified EPA methods. Other analytical test procedures are contained in Technical Notes on Drinking Water Methods, EPA-600/R-94-173, October 1994, NTIS PB95-104766.

(2) PCB analytical methodology. Analysis for PCBs shall be conducted using the methods in 41.5(1)*"b"*(1) and as follows:

1. Each system which monitors for PCBs shall analyze each sample using Method 505, 508, 508.1, or 525.2. Users of Method 505 may have more difficulty in achieving the required Aroclor detection limits than users of Method 508, 508.1, or 525.2.
2. If PCBs (as one of seven Aroclors) are detected in any sample analyzed using Method 505 or 508, the system shall reanalyze the sample using Method 508A to quantitate PCBs as decachlorobiphenyl.

PCB AROCLOR DETECTION LIMITS

Aroclor	Detection Limit (mg/L)
1016	0.00008
1221	0.02
1232	0.0005
1242	0.0003
1248	0.0001
1254	0.0001
1260	0.0002

3. Compliance with the PCB MCL shall be determined based upon the quantitative results of analyses using Method 508A.

41.5(2) *Organic chemicals occurring as (nontrihalomethane) disinfection by-products.* Reserved.

567—41.6(455B) Disinfection byproducts maximum contaminant levels and monitoring requirements.

41.6(1) *Disinfection byproducts.*

a. Applicability.

(1) This rule establishes criteria under which CWS and NTNC public water supply systems that add a chemical disinfectant to the water in any part of the drinking water treatment process or which provide water that contains a chemical disinfectant must modify their practices to meet the MCLs listed in this rule and the maximum residual disinfectant levels (MRDL) and treatment technique requirements for disinfection byproduct precursors listed in 567—43.6(455B).

(2) This rule establishes criteria under which TNC public water supply systems that use chlorine dioxide as a disinfectant or oxidant must modify their practices to meet the chlorine dioxide MRDL listed in 567—paragraph 43.6(1)*"b."*

(3) Compliance dates for this rule are based upon the source water type and the population served. Systems are required to comply with this rule as follows, unless otherwise noted. The department may assign an earlier monitoring period as part of the operation permit, but compliance with the maximum contaminant level is not required until the dates stated below.

1. Surface water and IGW CWS and NTNC. CWS and NTNC systems using surface water or groundwater under the direct influence of surface water in whole or in part and which serve 10,000 or more persons must comply with this rule beginning January 1, 2002. CWS and NTNC systems serving fewer than 10,000 persons must comply with this rule beginning January 1, 2004.

2. Groundwater CWS and NTNC. CWS and NTNC systems using only groundwater not under the direct influence of surface water must comply with this rule beginning January 1, 2004.

3. TNC using chlorine dioxide. TNC systems are not required to comply with this rule.

(4) Consecutive systems. Consecutive systems that provide water containing a disinfectant or oxidant are required to comply with this rule. A consecutive system may be incorporated into the sampling plan of the supply that produces the water (the primary water supplier), provided:

1. There is a mutual signed agreement between the primary and consecutive system supplied by that primary system that states the primary system will be responsible for the compliance of its consecutive system with this rule, regardless of additional treatment by the consecutive system.

2. Beginning with the primary water supply, each successive consecutive system must also be included in the primary supply's sampling plan, so that there is no system with its own sampling plan between the primary supply and the consecutive supply covered by the primary supply's plan.

3. It is understood by the primary and all consecutive systems that, even if only one system in the sampling plan has a violation, all systems in the sampling plan will receive the violation and be required to conduct public notification.

4. The department receives a copy of the signed agreement and approves the sampling plan prior to the beginning of the compliance period.

If a mutual agreement is not possible, each system (the primary system and each consecutive system) is responsible for compliance with this rule for its specific system.

(5) Systems with multiple water sources. Systems with water sources that are used independently from each other, are not from the same source as determined by the department, or do not go through identical treatment processes are required to conduct the monitoring for the applicable disinfectants or oxidants and disinfection byproducts during operation of each source. The system must comply with this rule during the use of each water source.

b. Maximum contaminant levels for disinfection byproducts. The maximum contaminant levels (MCLs) for disinfection byproducts are as follows:

Disinfection byproduct	MCL (mg/L)
Bromate	0.010
Chlorite	1.0
Haloacetic acids (HAA5)	0.060
Total trihalomethanes (TTHM)	0.080

c. Monitoring requirements for disinfection byproducts.

(1) General requirements.

1. Systems must take all samples during normal operating conditions.

2. Systems may consider multiple wells drawing water from a single aquifer as one treatment plant for determining the minimum number of TTHM and HAA5 samples required, with department approval.

3. Failure to monitor in accordance with the monitoring plan required under 41.6(1)"*c*"(1)"6" is a monitoring violation.

4. Failure to monitor is a violation for the entire period covered by the annual average where compliance is based on a running annual average of monthly or quarterly samples or averages, and the system's failure to monitor makes it impossible to determine compliance with MCLs.

5. Systems may use only data collected under the provisions of this rule or 567—43.6(455B) to qualify for reduced monitoring.

6. Each system required to monitor under the provisions of this rule or 567—43.6(455B) must develop and implement a monitoring plan. The system must maintain the plan and make it available for inspection by the department and the general public no later than 30 days following the applicable compliance dates in 41.6(1)"*a*"(3). All systems using surface water or groundwater under the direct influence of surface water and serving more than 3,300 people must submit a copy of the monitoring plan to the department by the applicable date in 41.6(1)"*a*"(3)"1." The department may also require the plan to be submitted by any other system. After review, the department may require changes in any plan elements. The plan must include at least the following elements:

- Specific locations and schedules for collecting samples for any parameters included in this rule.
- How the system will calculate compliance with MCLs, MRDLs, and treatment techniques.
- If providing water to one or more consecutive systems, and the consecutive systems have agreed to the sampling plan by the primary supplier of the water pursuant to 41.6(1)"*a*"(4), the sampling plan of the primary water supplier must reflect the entire distribution system.

7. The department may require a monthly monitoring frequency for disinfection byproducts, which would be specified in the operation permit.

(2) Bromate. Community and nontransient noncommunity systems using ozone for disinfection or oxidation must conduct monitoring for bromate.

1. Routine monitoring. Systems must take at least one sample per month for each treatment plant in the system using ozone, collected at each source/entry point to the distribution system while the ozonation system is operating under normal conditions.

2. Reduced monitoring. The department may allow systems required to analyze for bromate to reduce monitoring from monthly to once per quarter if the system demonstrates that the average source water bromide concentration is less than 0.05 mg/L based upon representative monthly bromide measurements for one year. The system may remain on reduced bromate monitoring until the running annual average source water bromide concentration, computed quarterly, is greater than or equal to 0.05 mg/L based upon representative monthly measurements. If the running annual average source water bromide concentration is greater than or equal to 0.05 mg/L, the system must resume routine monitoring required by 41.6(1)*"c"*(2)"1."

(3) Chlorite. Community and nontransient noncommunity water systems using chlorine dioxide, for disinfection or oxidation, must conduct monitoring for chlorite.

1. Routine daily monitoring. Systems must take daily samples at the entrance to the distribution system. For any daily sample that exceeds the chlorite MCL, the system must take additional samples in the distribution system the following day at the locations required by 41.6(1)*"c"*(3)"3," which are in addition to the sample required at the entrance to the distribution system.

2. Routine monthly monitoring. Systems must take a three-sample set each month in the distribution system. The system must take one sample at each of the following locations: near the first customer, at a location representative of average residence time, and at a location reflecting maximum residence time in the distribution system. Any additional routine sampling must be conducted in the same manner (as three-sample sets, at the specified locations). The system may use the results of additional monitoring conducted in accordance with 41.6(1)*"c"*(3)"3" to meet the requirement for monitoring in this subparagraph.

3. Additional monitoring. On each day following a routine sample monitoring result that exceeds the chlorite MCL at the entrance to the distribution system, the system is required to take three chlorite distribution system samples at the following locations: as close to the first customer as possible, in a location representative of average residence time, and as close to the end of the distribution system as possible (reflecting maximum residence time in the distribution system).

4. Reduced monitoring.

- Daily chlorite monitoring at the entrance to the distribution system required by 41.6(1)*"c"*(3)"1" may not be reduced.
- The department may allow systems with monthly chlorite monitoring in the distribution system required by 41.6(1)*"c"*(3)"2" to be reduced to a requirement of 1 three-sample set per quarter after one year of monitoring where no individual chlorite sample taken in the distribution system under 41.6(1)*"c"*(3)"2" has exceeded the chlorite MCL and the system has not been required to conduct additional monitoring under 41.6(1)*"c"*(3)"3." The system may remain on the reduced monitoring schedule until either any of the three individual chlorite samples taken quarterly in the distribution system under 41.6(1)*"c"*(3)"2" exceeds the chlorite MCL or the system is required to conduct monitoring under 41.6(1)*"c"*(3)"3" of this rule, at which time the system must revert to routine monitoring.

(4) Total trihalomethanes (TTHM) and haloacetic acids (HAA5).

1. Routine monitoring. Systems must monitor at the frequency indicated in the following table:

Routine Monitoring Frequency for TTHM and HAA5

Type of System (source water type and population served)	Minimum Monitoring Frequency	Sample Location in the Distribution System
SW/IGW[3] system serving ≥10,000 persons	Four water samples per quarter per treatment plant	At least 25 percent of all samples collected each quarter at locations representing maximum residence time. Remaining samples taken at locations representative of at least average residence time in the distribution system and representing the entire distribution system, taking into account number of persons served, different sources of water, and different treatment methods.[1]
SW/IGW[3] system serving 500 - 9,999 persons	One water sample per quarter per treatment plant	Locations representing maximum residence time.[1]
SW/IGW[3] system serving <500 persons	One sample per year per treatment plant during month of warmest water temperature	Locations representing maximum residence time.[1] If the sample (or average of annual samples, if more than one sample is taken) exceeds MCL, system must increase monitoring to one sample per treatment plant per quarter, taken at a point reflecting the maximum residence time in the distribution system, until system meets reduced monitoring criteria in 41.6(1)"*c*"(4)"2," fourth unnumbered paragraph.
System using only non-IGW groundwater using chemical disinfectant and serving ≥10,000 persons	One water sample per quarter per treatment plant[2]	Locations representing maximum residence time.[1]
System using only non-IGW groundwater using chemical disinfectant and serving <10,000 persons	One sample per year per treatment plant during month of warmest water temperature	Locations representing maximum residence time.[1] If the sample (or average of annual samples, if more than one sample is taken) exceeds MCL, system must increase monitoring to one sample per treatment plant per quarter, taken at a point reflecting the maximum residence time in the distribution system, until system meets reduced monitoring criteria in 41.6(1)"*c*"(4)"2," fourth unnumbered paragraph.

[1] If a system chooses to sample more frequently than the minimum required, at least 25 percent of all samples collected each quarter (including those taken in excess of the required frequency) must be taken at locations that represent the maximum residence time of the water in the distribution system. The remaining samples must be taken at locations representative of at least average residence time in the distribution system.

[2] Multiple wells drawing water from a single aquifer may be considered one treatment plant for determining the minimum number of samples required, with department approval.

[3] SW/IGW indicates those systems that use either surface water (SW) or groundwater under the direct influence of surface water (IGW), in whole or in part.

2. Reduced monitoring. The department may allow systems a reduced monitoring frequency, except as otherwise provided, in accordance with the following table. Source water total organic carbon (TOC) levels must be determined in accordance with 567—subparagraph 43.6(2)*"c"*(1).

Reduced Monitoring Frequency for TTHM and HAA5

If you are a . . .	And you have monitored at least one year and your . . .	You may reduce monitoring to this level
SW/IGW[1] system serving ≥10,000 persons which has a source water annual average TOC level, before any treatment, of ≤4.0 mg/L.	TTHM annual average ≤0.040 mg/L and HAA5 annual average ≤0.030 mg/L	One sample per treatment plant per quarter at distribution system location reflecting maximum residence time.
SW/IGW[1] system serving 500 - 9,999 persons that has a source water annual average TOC level, before any treatment, of ≤4.0 mg/L.	TTHM annual average ≤0.040 mg/L and HAA5 annual average ≤0.030 mg/L	One sample per treatment plant per year at distribution system location reflecting maximum residence time during month of warmest water temperature.
SW/IGW[1] system serving <500 persons	Any SW/IGW[1] system serving <500 persons may not reduce its monitoring to less than one sample per treatment plant per year.	
System using only non-IGW groundwater using chemical disinfectant and serving ≥10,000 persons	TTHM annual average ≤0.040 mg/L and HAA5 annual average ≤0.030 mg/L	One sample per treatment plant per year at distribution system location reflecting maximum residence time during month of warmest water temperature.
System using only non-IGW groundwater using chemical disinfectant and serving <10,000 persons	TTHM annual average ≤0.040 mg/L and HAA5 annual average ≤0.030 mg/L for two consecutive years; or, TTHM annual average ≤0.020 mg/L and HAA5 annual average ≤0.015 mg/L for one year.	One sample per treatment plant per three-year monitoring cycle at distribution system location reflecting maximum residence time during month of warmest water temperature, with the three-year cycle beginning on January 1 following quarter in which system qualifies for reduced monitoring.

[1] SW/IGW indicates those systems that use either surface water (SW) or groundwater under the direct influence of surface water (IGW), in whole or in part.

- Systems on a reduced monitoring schedule may remain on that reduced schedule as long as the average of all samples taken in the year (for systems which must monitor quarterly) or the result of the sample (for systems which must monitor no more frequently than annually) is less than or equal to 0.060 mg/L for TTHMs and is less than or equal to 0.045 mg/L for HAA5. Systems that do not meet these levels must resume monitoring at the frequency identified in 41.6(1)*"c"*(4)"1" in the quarter immediately following the quarter in which the system exceeds 0.060 mg/L for TTHMs and 0.045 mg/L for HAA5. For systems using only groundwater not under the direct influence of surface water and serving fewer than 10,000 persons, if either the TTHM annual average is >0.080 mg/L or the HAA5 annual average is >0.060 mg/L, the system must go to increased monitoring identified in 41.6(1)*"c"*(4)"1."

- The department may allow systems on increased monitoring to return to routine monitoring if TTHM annual average is less than or equal to 0.040 mg/L and HAA5 annual average is less than or equal to 0.030 mg/L.
- The department may return a system to routine monitoring at the department's discretion.

d. Analytical requirements for disinfection byproducts.

(1) Systems must use only the analytical method(s) specified in this paragraph, or equivalent methods as determined by EPA, to demonstrate compliance with the requirements of this rule.

(2) Systems must measure disinfection byproducts by the methods (as modified by the footnotes) listed in the following table:

Approved Methods for Disinfection Byproduct Compliance Monitoring

Methodology[2]	EPA	Standard Methods	Byproduct measured[1]			
			TTHM	HAA5	Chlorite[4]	Bromate
P&T/GC/EICD & PID	502.2[3]		X			
P&T/GC/MS	524.2		X			
LLE/GC/ECD	551.1		X			
LLE/GC/ECD		6251 B		X		
SPE/GC/ECD	552.1			X		
LLE/GC/ECD	552.2			X		
Amperometric Titration		4500-ClO_2E			X	
IC	300.0				X	
IC	300.1				X	X

The procedures shall be done in accordance with the documents listed below. The incorporation by reference of the following documents was approved by the Director of the Federal Register on February 16, 1999, in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the documents may be obtained from the sources listed below. Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at (800)426-4791. Documents may be inspected at EPA's Drinking Water Docket, 401 M Street SW, Washington, DC 20460 (telephone: (202)260-3027); or at the Office of Federal Register, 800 North Capitol Street NW, Suite 700, Washington, DC.

The following method is available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohoken, PA 19428:

Annual Book of ASTM Standards, Volume 11.01, American Society for Testing and Materials, 1996: Method D 1253-86.

The following methods are available from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161 (telephone: (800)553-6847):

"Determination of Inorganic Anions in Drinking Water by Ion Chromatography, Revision 1.0," EPA-600/R-98/118, 1997 (available through NTIS, PB98-169196): Method 300.1.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993, (NTIS PB94-121811): Method 300.0.

Methods for the Determination of Organic Compounds in Drinking Water—Supplement II, EPA-600/R-92-129, August 1992 (NTIS PB92-207703): Method 552.1.

Methods for the Determination of Organic Compounds in Drinking Water—Supplement III, EPA-600/R-95-131, August 1995 (NTIS PB95-261616): Methods 502.2, 524.2, 551.1, and 552.2.

The following methods are available from the American Public Health Association, 1015 Fifteenth Street NW, Washington, DC 20005:

Standard Methods for the Examination of Water and Wastewater, 19th edition, American Public Health Association, 1995: Methods: 4500-Cl D, 4500-Cl E, 4500-Cl F, 4500-Cl G, 4500-Cl H, 4500-Cl I, 4500-ClO_2 D, 4500-ClO_2 E, 6251 B, and 5910 B.

Standard Methods for the Examination of Water and Wastewater, Supplement to the 19th edition, American Public Health Association, 1996: Methods: 5310 B, 5310 C, and 5310 D.

[1] X indicates method is approved for measuring specified disinfection byproduct.

[2] ECD = electron capture detector; EICD = electrolytic conductivity detector; GC = gas chromatography; IC = ion chromatography; LLE = liquid/liquid extraction; MS = mass spectrometer; P&T = purge and trap; PID = photoionization detector; SPE = solid phase extractor

[3] If TTHMs are the only analytes being measured in the sample, then a PID is not required.

[4] Amperometric titration may be used for routine daily monitoring of chlorite at the entrance to the distribution system, as prescribed in 41.6(1)*"c"*(3)"1." Ion chromatography must be used for routine monthly monitoring of chlorite and additional monitoring of chlorite in the distribution system, as prescribed in 41.6(1)*"c"*(3)"2" and "3."

(3) Certified laboratory requirements. Analyses under this rule for disinfection byproducts shall only be conducted by laboratories that have been certified by the department and are in compliance with the requirements of 567—Chapter 83, except as specified under 41.6(1)*"d"*(4).

(4) Daily chlorite samples at the entrance to the distribution system must be measured by a Grade II, III or IV operator meeting the requirements of 567—Chapter 81, any person under the supervision of a Grade II, III or IV operator meeting the requirements of 567—Chapter 81, or a laboratory certified by the department to perform analysis under 567—Chapter 83.

e. Compliance requirements for disinfection byproducts.

(1) General requirements.

1. When compliance is based on a running annual average of monthly or quarterly samples or averages and the system fails to monitor for TTHM, HAA5, or bromate, this failure to monitor will be treated as a monitoring violation for the entire period covered by the annual average.

2. Unless invalidated by the department, all samples taken and analyzed under the provisions of this rule must be included in determining compliance, even if that number is greater than the minimum required.

3. If, during the first year of monitoring under paragraph 41.6(1)*"c,"* any individual quarter's average will cause the running annual average of that system to exceed the MCL, the system is out of compliance at the end of that quarter.

(2) Bromate. Compliance must be based on a running annual arithmetic average, computed quarterly, of monthly samples (or, for months in which the system takes more than one sample, the average of all samples taken during the month) collected by the system as prescribed by 41.6(1)*"c"*(2). If the average of samples covering any consecutive four-quarter period exceeds the MCL, the system is in violation of the MCL and must notify the public pursuant to 567—Chapter 42, in addition to reporting to the department pursuant to 567—paragraph 42.4(3)*"d."* If a PWS fails to complete 12 consecutive months' monitoring, compliance with the MCL for the last four-quarter compliance period must be based on an average of the available data.

(3) Chlorite. Compliance must be based on an arithmetic average of each three-sample set taken in the distribution system as prescribed by 41.6(1)*"c"*(3)"1" and 41.6(1)*"c"*(3)"2." If the arithmetic average of any three-sample set exceeds the MCL, the system is in violation of the MCL and must notify the public pursuant to 567—Chapter 42, in addition to reporting to the department pursuant to 567—paragraph 42.4(3)*"d."*

(4) TTHM and HAA5.

1. For systems monitoring quarterly, compliance with MCLs in 41.6(1)*"b"* must be based on a running annual arithmetic average, computed quarterly, of quarterly arithmetic averages of all samples collected by the system as prescribed by 41.6(1)*"c"*(4).

2. For systems monitoring less frequently than quarterly, systems demonstrate MCL compliance if the average of samples taken that year under the provisions of 41.6(1)*"c"*(4) does not exceed the MCLs in 41.6(1)*"b."* If the average of these samples exceeds the MCL, the system must increase monitoring to once per quarter per treatment plant and is not in violation of the MCL until it has completed one year of quarterly monitoring, unless the result of fewer than four quarters of monitoring will cause the running annual average to exceed the MCL, in which case the system is in violation at the end of that quarter. Systems required to increase to quarterly monitoring must calculate compliance by including the sample that triggered the increased monitoring plus the following three quarters of monitoring.

3. If the running annual arithmetic average of quarterly averages covering any consecutive four-quarter period exceeds the MCL, the system is in violation of the MCL and must notify the public pursuant to 567—Chapter 42 in addition to reporting to the department pursuant to 567—paragraph 42.4(3)*"d."*

4. If a PWS fails to complete four consecutive quarters of monitoring, compliance with the MCL for the last four-quarter compliance period must be based on an average of the available data.

f. Reporting requirements for disinfection byproduct precursors. Systems required to sample quarterly or more frequently must report to the department within ten days after the end of each quarter in which samples were collected, notwithstanding the public notification provisions of 567—42.1(455B). Systems required to sample less frequently than quarterly must report to the department within ten days after the end of each monitoring period in which samples were collected. The specific reporting requirements for disinfection byproducts are listed in 567—subparagraph 42.4(3)*"d"*(2).

41.6(2) Reserved.

567—41.7(455B) Physical properties maximum contaminant levels (MCL or treatment technique requirements) and monitoring requirements. Rescinded IAB 10/18/00, effective 11/22/00.

567—41.8(455B) Radionuclides.

41.8(1) *Radium-226, radium-228, and gross alpha particle radioactivity in community water systems.* The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

	MCL
a. Combined radium-226 and radium-228	5 pCi/l
b. Gross alpha particle activity (including radium-226 but excluding radon and uranium)	15 pCi/l

41.8(2) Beta particle and photon radioactivity from man-made radionuclides in community water systems.

a. Maximum contaminant level. The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

b. MCL calculation. Except for the radionuclides listed in the table below, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

AVERAGE ANNUAL CONCENTRATIONS ASSUMED TO PRODUCE
A TOTAL BODY OR ORGAN DOSE OF 4 MREM/YR

Radionuclide	Critical Organ	pCi per liter
Strontium-90	Bone marrow	8
Tritium	Total body	20,000

567—41.9(455B) Sampling and analytical requirements for radionuclides.

41.9(1) *Analytical methods for radioactivity.*

a. Radionuclide analytical methodology. Analysis for the following contaminants shall be conducted to determine compliance with 41.8(1) in accordance with the methods in the following table, or their equivalent as determined by EPA.